C. *Fertile fronds.* Fully bipinnate; lower segments bead-like, the upper partially unrolled; secondary rachises spreading.

D. Var. *obtusilobata*, Torr. Pinnae pinnatifid throughout their whole extent; segments very strongly revolute, those nearest the base of the pinnae sometimes bead-like, as in normal fertile fronds ; sporangia present in some of the indusia, even when the segments are only moderately revolute.

E. *Sterile fronds.* $\frac{1}{2}$–$\frac{1}{3}$ the normal size; pinnae cut entirely to the midribs in their lower half; primary rachis wingless; margins moderately revolute; indusia present, conspicuous, 2–6 to each segment; sporangia none, or merely rudimentary.

F. *Sterile fronds.* Form similar to "E" but with pinnae less deeply cut and with mere traces of indusia on the basal segments.

G. *Sterile fronds.* Size and outline normal; primary rachis only slightly winged ; margins slightly revolute.

H. *Normal sterile fronds* with primary rachis broadly winged, except between the lowest pairs of pinnae.

It will thus be seen that there may occur all possible forms intermediate between the sterile and fertile fronds, and that Dr. Torrey's var. *obtusilobata* is on the boundary line between the two.

In the present instance the *cause* of this variation seemed very apparent. The meadow in which these forms were found was cut late in June, before the fertile fronds were grown, thus destroying the earlier-formed sterile fronds. The vitality of the plant thus finding no outlet save through the growing fertile fronds, and the plant requiring an expanse of foliage, a result was reached intermediate between the fertile and sterile fronds. The following facts may serve to substantiate this view:

1. Wherever the sterile fronds had been entirely cut away, the variations appeared which approximated most closely to the sterile fronds.

2. Where the sterile fronds were only partly destroyed on one rhizoma, variations appeared not very divergent from the normal fertile fronds.

3. Where the sterile fronds remained intact, no variations were found, even after diligent search.

4. In places where the plants were too much reduced to bear fertile fronds under favorable conditions, no variations occurred, even when the sterile fronds were entirely cut away.

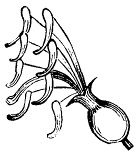
Whether the above explanation will prove satisfactory for all forms of the so-called var. *obtusilobata* wherever found, remains an open question; as a true variety, however, *obtusilobata* has no place, and it would be well if many more of other numerous forms that have been raised to the dignity of *varieties* could be consigned to a grave so secure.

West Goshen, Conn. LUCIEN M. UNDERWOOD.

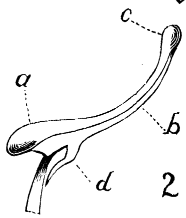
§ 96. **Fertilization of Rhexia Virginica,** L.—I have often wondered how ever the pollen escapes from such anthers as those of *Rhexia* and *Cassia*, indehiscent, with small and, in the present case, almost invisible pores. Nuttall seems to have felt the same diffi-

culty; for, as quoted by Prof. Goodale, in "Wild Flowers of America," he thinks that the pollen of *Rhexia* escapes by a clandestine opening, protected by a seta near where the filament unites with the connective. I have not the book at hand to quote the precise words, but the fact that Prof. Goodale, who is well aware of the pore at the top of the anther-cell, quotes Nuttall's explanation, seems to imply that he himself was not satisfied as to the capacity of the pore to provide escape for the pollen. Insects are so clever in getting at the floral reservoirs in spite of the contrivances of Nature, that Nuttall may have been misled by some of their operations; but, as we shall see, there is abundant means for the escape of the pollen in the regular way.

If we open the bud of a *Rhexia* just about to expand, we find the pistil rising considerably above the circle of 8 stamens which surround it, but with the lobes of the stigma yet unseparated. In this stage the stamens are inflexed, so that the anther is enclosed between the filament and the style, the back of the connective resting on the style and the poliniferous tube confined between the connective and the filament. The "seta," or small spur at the base of the connective, is pressed between the latter and the style. Evidently there is no room here for cleistogamy. But, when the flower expands, the stamens arrange themselves in two sets, four on each side of the style, as shown in the side view, Fig. 1. Each anther stands atip on the top of its filament, so that, while the vertex is turned toward the lower part of the flower, it is nevertheless much more elevated above the floral plane than the puffed-out lower portion.



1



2

The poliniferous portion of the anther, Fig. 2, consists of a single sack, which may be described as consisting of three parts: an inflated lower portion (*a*); a narrow tube; and a very small oblate spheroid (*c*), flattened parallel to the upper surface of the anther, and, of course, having its axis perpendicular to that surface. The upper pole of this tiny spheroid contains a pore, so small as to be hardly discernible to the naked eye. Owing to the curve of the anther this pore faces towards, but upwards from its base. Under the poliniferous sack is the connective (*b*), reaching from the top to near the lower end, where it is overlapped by the inflated portion. A very little above the base of the connective the filament is attached, and just above this again, the small spur-like process (*d*) issues from the connective and presses with its point the upper part of the filament, whose extreme top is bent slightly backward.

While the stamens have been attaining their position, the style elongates, bends downward and turns up its stigma, which thus becomes considerably below and behind the anthers. At the same time its lobes separate and the viscid stigmatic surface is exposed. In this position the stigma affords the first resting-place for a bee alighting on the flower, and must catch any pollen that may be ad-

hering to its abdomen. As the bee advances upward toward the tube of the calyx, he treads upon the inflated sacks at the base of the anthers, which yield to the pressure and, acting like a bellows, force through the minute pore a jet of the minuter pollen directly upon the rear or side of the intruder, but directly away from the stigma. I have seen an humble-bee upon a flower, pressing with his feet on the bellows, but, of course, could not get near enough to see the play of the pollen. It may easily be seen, however, by touching the bellows with a blunt point, when a surprising quantity of pollen will be thrown upon the instrument. A sharp point, like that of a pin, would be apt to perforate and spoil the delicate bellows. When touched in this way, it will be noticed that simultaneously with the jet of pollen the anther springs forward as if to aid the expulsive force, and then immediately springs back. In fact, my first impression was that it was this jerk which discharged the pollen. It is easily accounted for by the disposition of the parts as I have described them. The spur of the connective seems to act as a buttress to keep the anther in its tilted position.

It is evident that here is a very perfect contrivance for securing cross-fertilization, at least to a considerable extent. Though each plant of *Rhexia* produces a number of flowers, yet only one or two are usually in bloom at the same time, and these probably in different stages of advancement. The petals, which are the signals inviting insects, last but for a day or perhaps even a shorter time.

There are other points in the structure of *Rhexia* ; the glandular hairs on the petals as well as other parts of the plant; the wing-angled stems, etc., which would repay study, if one had the plants accessible. For some of these observations I am indebted to my associate, Mr. Gerard.

In the case of *Cassia Marilandica*, I have watched an humble-bee hugging an anther, and apparently, so to speak, milking out the pollen.

W. H. L.

§ 97. **The Herbaria and Botanical Libraries of the United States. VIII.**—The Herbarium of Cornell University numbers not far from 18,000 species. The larger part of the collection is made up of the herbarium of the late Horace Mann, Jr., which was purchased by President White and presented to the University soon after its opening in 1868. This is a general collection, but is especially rich in Sandwich Island plants. The principal additions since made include the Brazilian plants collected by the officers and students of the University in their expedition to South America in 1870; the Western United States plants collected in connection with the Government surveys of the Western Territories; small collections, some of them European, donated from various sources; and a very nearly complete collection of the plants growing in Central New York, comprising especially the flora of Cayuga Lake Valley. A full set of the latter, numbering about 1,300 species of phaenogamia and vascular cryptogamia, and known as the "local herbarium," is kept separate from the main collection for the convenience of students making a somewhat careful study of the whole or of some group of the local